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C L A I M S

1. Drilling system for drilling a bore hole into an earth formation, the bore hole having an inside wall, and the system comprising:

- 5 - a drill string reaching into the bore hole leaving a drilling fluid return passage between the drill string and the bore hole inside wall;
 - a drilling fluid discharge conduit in fluid communication with the drilling fluid return passage;
 - 10 - pump means for pumping a drilling fluid through the drill string into the bore hole and to the drilling fluid discharge conduit via the drilling fluid return passage;
 - back pressure means for controlling the drilling fluid back pressure;
 - 15 - an injection fluid injection system comprising an injection fluid supply passage fluidly connecting an injection fluid supply with the drilling fluid return passage and further comprising an injection fluid pressure sensor arranged to provide a pressure signal in accordance with an injection fluid pressure in the
 - 20 injection fluid supply passage;
 - back pressure control means for controlling the back pressure means whereby the back pressure control means is arranged to receive the pressure signal and to regulate the back pressure means in dependence of at least the
 - 25 pressure signal.
2. The system of claim 1, wherein the drill string reaches into the bore hole from a surface level and the injection fluid pressure sensor is provided on or close to the surface level.

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3. The system of claim 1 or 2, wherein the back pressure means are arranged to control the discharge of drilling fluid from the drilling fluid return passage.

5 4. The system of any one of claims 1 to 3, wherein the back pressure means comprises a variable flow restrictive device arranged in a path for the flow of drilling fluid downstream of a point where the injection fluid supply passage connects to the drilling fluid return passage.

10 5. The system of any one of the previous claims, wherein the fluid injection means is arranged to inject an injection fluid having a mass density different from that of the drilling fluid, preferably the injection fluid having a mass density that is lower than that of the drilling fluid.

15 6. The system of any one of the previous claims, wherein the back pressure control means comprises a programmable pressure monitoring and control system arranged to calculate a predicted down hole pressure using a model and thereby utilising least the pressure signal, compare
20 the predicted down hole pressure to a desired down hole pressure, and to utilize the differential between the calculated and desired pressures to control said fluid back pressure means.

25 7. The system of claim 6, wherein a bottom hole assembly is provided on a lower end of the drill string, the bottom hole assembly comprising a down hole sensor and a down hole telemetry system for transmitting data, including down hole sensor data, the down hole sensor data at least representing down hole pressure data, and
30 the system further comprises a surface telemetry system for receiving the down hole sensor data, and the programmable pressure monitoring and control system is arranged to compare the predicted down hole pressure with the down hole sensor data.

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8. Method of drilling a bore hole into an earth formation, the bore hole having an inside wall, the drilling method comprising the steps of:

- 5 - deploying a drill string into the bore hole and forming a drilling fluid return passage between the drill string and the bore hole inside wall;
 - 10 - pumping a drilling fluid through the drill string into the bore hole and via the drilling fluid return passage to a drilling fluid discharge conduit arranged in fluid communication with the drilling fluid return passage;
 - 15 - controlling a drilling fluid back pressure by controlling back pressure means;
 - injecting an injection fluid from an injection fluid supply via an injection fluid supply passage into the drilling fluid in the drilling fluid return passage;
 - 20 - generating a pressure signal in accordance with an injection fluid pressure in the injection fluid supply passage;
 - controlling the back pressure means, which controlling comprises regulating the back pressure means in dependence of at least the pressure signal.
9. Drilling system substantially as described hereinbefore with reference to the drawings.
- 25 10. Method substantially as described hereinbefore with reference to the drawings